

State of Montana
Department of Justice
Forensic Science Division
Chemical Analysis Unit

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406 255-1104



Missoula Lab located at:
2679 Palmer Street, Missoula, MT 59808



Billings Lab Located at:
1516 4th Ave. North Suite 1, Billings, MT 59101

Chemical Analysis Unit

- One supervisor and 2 chemists in Billings and five chemists in Missoula
- Scientists: minimum of Bachelor's degree in science or related field.
- Currently the chemists in the section have either a Master's Degree or are certified in Drug Analysis by American Board of Criminalistics (ABC-DA)

Missoula Chemistry Lab



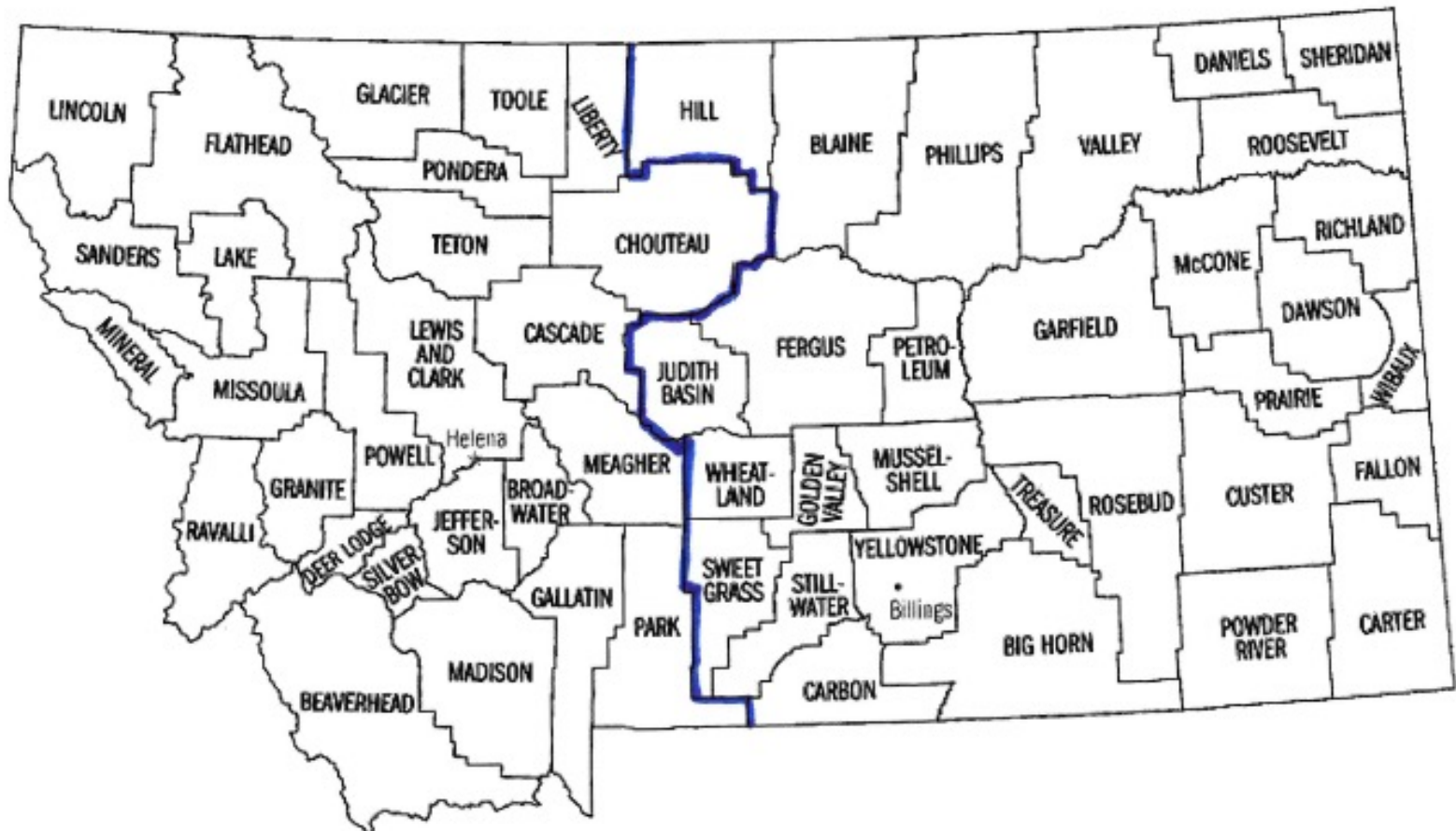
Billings Chemistry Lab



EVIDENCE EXAMINTED BY THE CHEMISTRY SECTION

- Controlled Substances
- Clandestine Laboratories
- Gunshot Residue

Section United Montana Divided



Controlled Substances

- Determine if a sample contains a dangerous drug (controlled substance)
- Report based on placement in the MCA or ARM
- Substituted compounds – Amphetamines, Cathinones & Synthetic cannabinoids
- Analogues – A slight modification to the chemical structure to circumvent the law.
 - Fentanyl and Benzodiazepine analogues

Dangerous Drugs

- Per Definitions under 50-32-101
- “Dangerous drug” means a drug, substance, or immediate precursor in Schedules I through V set forth in Title 50, chapter 32, part 2.

Dangerous Drug Analogue

- "Dangerous drug analogue" means any material, compound, mixture, or preparation that is structurally related to or chemically derived from any dangerous drug in Schedules I through V set forth in Title 50, chapter 32, part 2, or that is expressly or impliedly represented to produce or does produce a physiological effect similar to or greater than the effect of a dangerous drug in Schedules I through V.

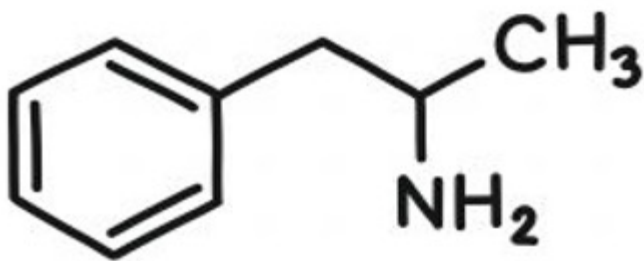
Dangerous Drug Analogue

- The term does not include any material, compound, mixture, or preparation that is currently listed as a dangerous drug in Schedules I through V set forth in Title 50, chapter 32, part 2, or in an administrative rule, that is approved for use by the United States food and drug administration, or that is otherwise specifically excepted from Title 50, chapter 32, part 2.

Types of Dangerous Drugs

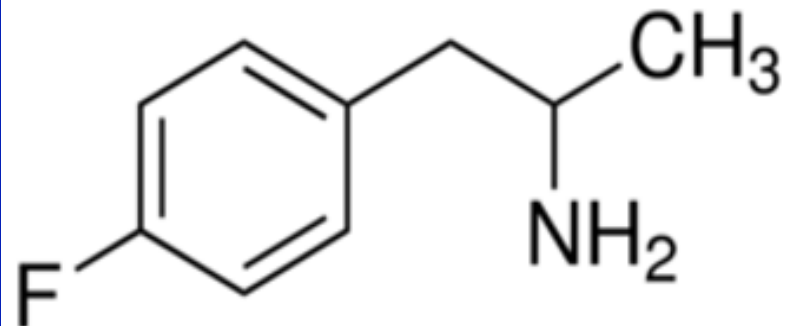
- Substituted Amphetamines (meth, DOB)
- Substituted Cathinones (commonly termed “bath salts” – Pentylone is one example)
- Synthetic Cannabinoids (JWH-018, XLR-11)
- Fentanyl Analogues (valeryl fentanyl)
- Benzodiazepine Analogues (etizolam)
- Plus many others

Substituted Amphetamines



Amphetamine

Schedule II dangerous drug
per MCA 50-32-224(3)(a)



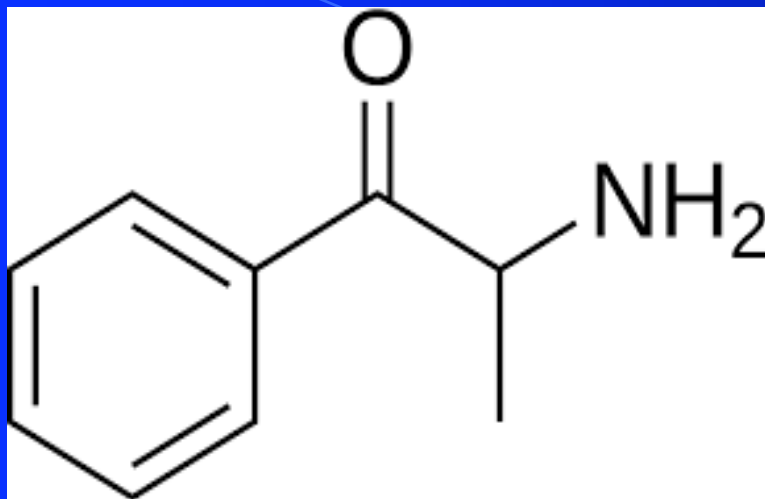
4-Fluoroamphetamine

Schedule I dangerous drug
as a Substituted Amphetamine per
MCA 50-32-222(4)(nm)(i)

Ecstasy or MDMA

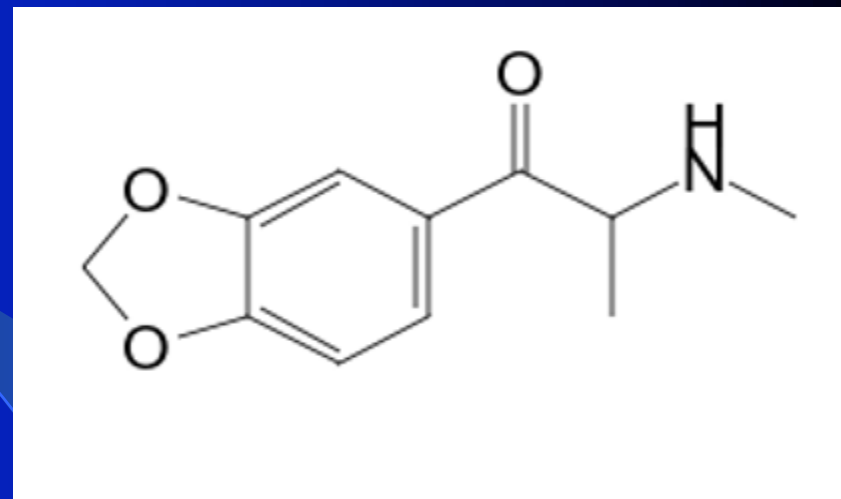


Substituted Cathinones



Cathinone

Schedule I dangerous drug
Per MCA 50-32-222(7)(b)



Methytlone

Schedule I dangerous drug
as a Substituted Cathinone per
MCA 50-32-222(4)(mm)(i) and (iii)

Bath Salts



Synthetic Cannabinoids

- Schedule I dangerous drugs
- Some are specifically listed
- Eight backbone structures are listed
- 50-32-222(4)(kk)(ii): any compound that has been demonstrated to have agonist binding activity at one or more cannabinoid receptors or is a chemical analog or isomer of a compound that has been demonstrated to have agonist binding activity at one or more cannabinoid receptors;

Synthetic Cannabinoids



Fentanyl

- Powerful synthetic opioid analgesic
- Approximately 80 times stronger than morphine
- Approximately 50 times stronger than heroin
- Schedule II controlled substance
- Medical Use: used to treat patients with severe pain

Fentanyl



Lethal dose: Fentanyl is deadlier than Heroin

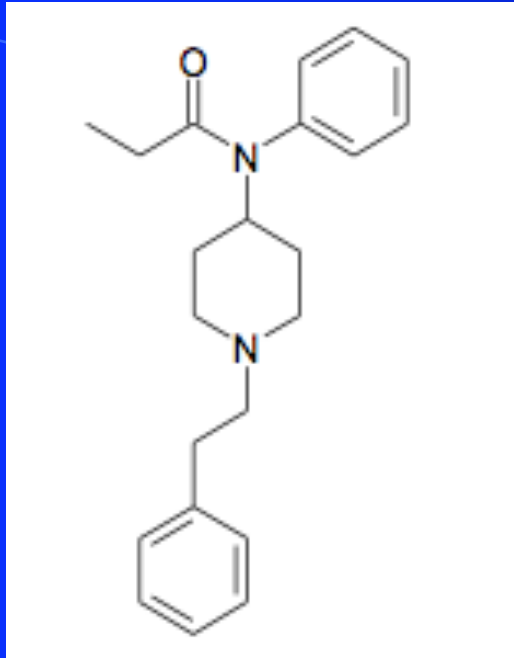
Fentanyl



Fentanyl

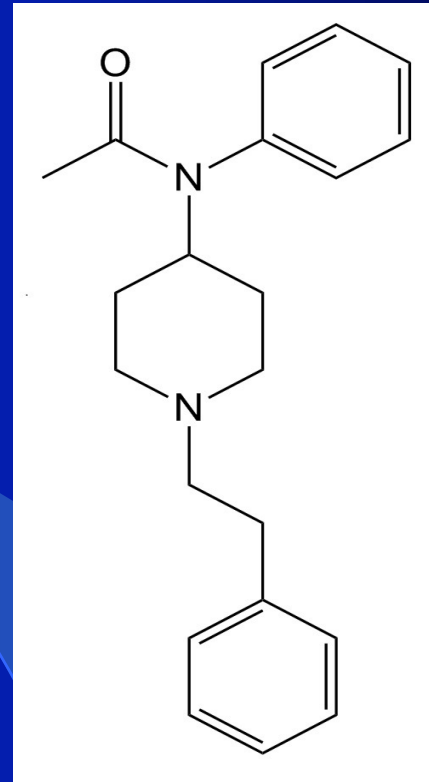


Fentanyl Analogues



Fentanyl

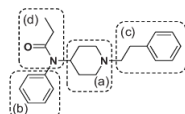
Schedule II dangerous drug
per MCA 50-32-224(3)(a)



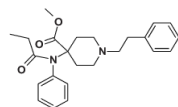
Acetyl Fentanyl

Schedule I dangerous drug
Analogue of Fentanyl per
MCA 50-32-222(10)

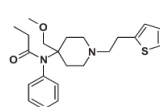
Fentanyl Analogues



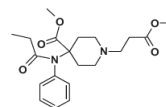
Fentanyl



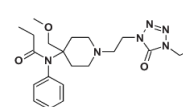
Carfentanyl



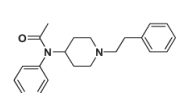
Sufentanil



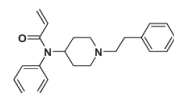
Remifentanyl



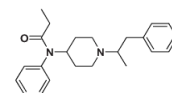
Alfentanil



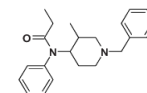
Acetylfentanyl



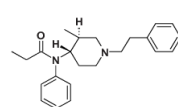
Acryloylfentanyl



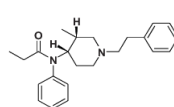
α-Methylfentanyl



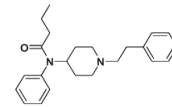
Isorfentanyl



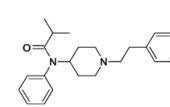
(+)-*Trans*-3-methylfentanyl
(3*S*,4*S*-configuration)*



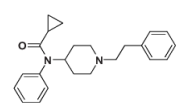
(+)-*Cis*-3-methylfentanyl
(3*R*,4*S*-configuration)*



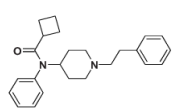
Butyrfentanyl



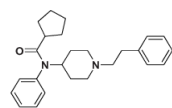
Isobutyrfentanyl



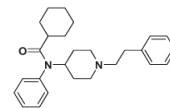
Cyclopropylfentanyl



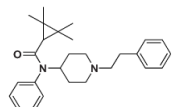
Cyclobutylfentanyl



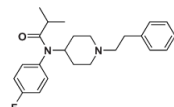
Cyclopentylfentanyl



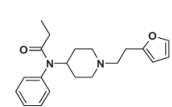
Cyclohexylfentanyl



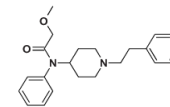
2,2,3,3-Tetramethyl-
cyclopropylfentanyl



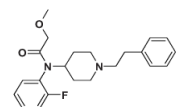
4-Fluoroisobutyrfen-
tanyl



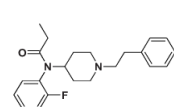
Furanylfentanyl



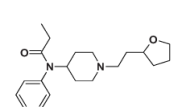
Methoxyacetylfentanyl



Ocfentanyl



Ortho-fluorofentanyl



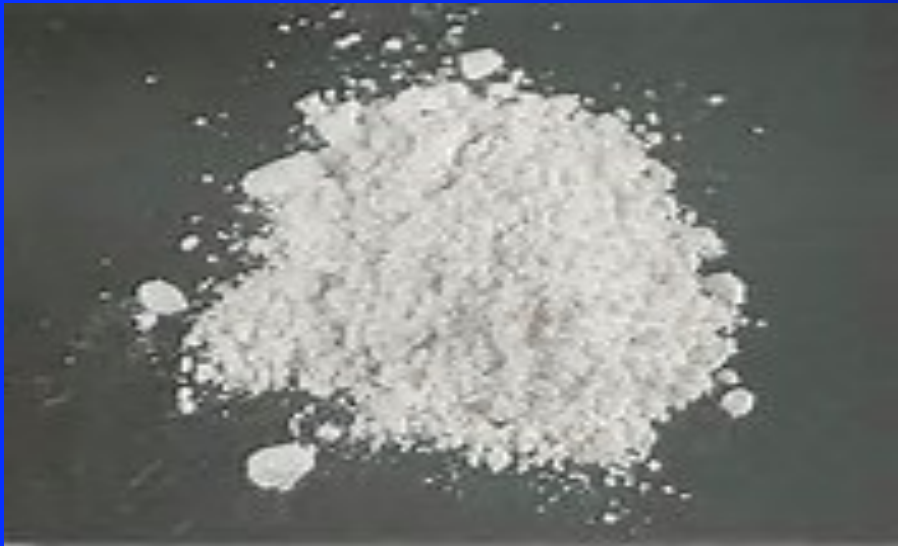
Tetrahydrofuran-
fentanyl

Fentanyl Analogues

- The list seems endless
- ~ 200 Fentanyl related items analyzed in 2021
- ~ 830 Fentanyl related items analyzed in 2022
- ~25 % of cases analyzed contain fentanyl or a fentanyl related compound in 2022
- Just recently started analyzing overdose cases when suspected controlled substances are located at scene

Fentanyl and analogues

Commonly mistaken as heroin or methamphetamine when in powder form



Most common submission

Fentanyl and analogues have been found in pharmaceutical tablets, both adulterated and counterfeit. We have found both types in Montana. M30 tablets, seen in earlier slide, is currently the most prevalent submission.



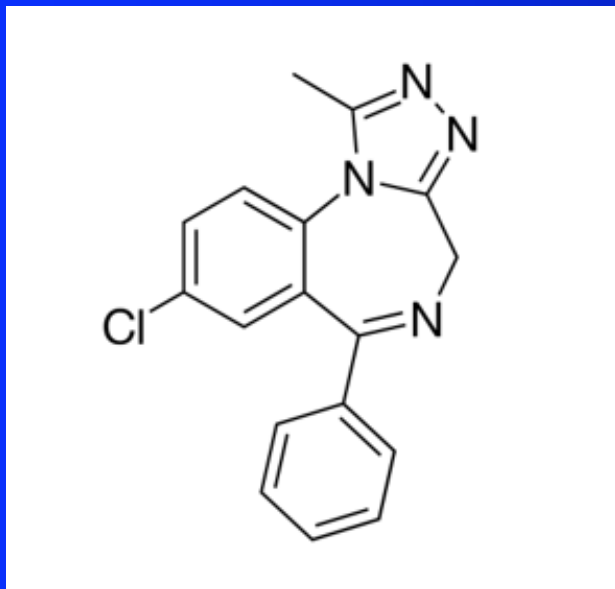
Concerns

- ❑ Exposure – can be absorbed thru the skin or inhaled. High overdose risk since it is so potent at very low concentrations
- ❑ Mixtures – typically found with other substances such as veterinary drugs and acetaminophen
- ❑ Health – overdoses are occurring at alarming rate
- ❑ Treatment – Narcan can reverse the effects but will require much more than the normal dose

Benzodiazepine Analogues

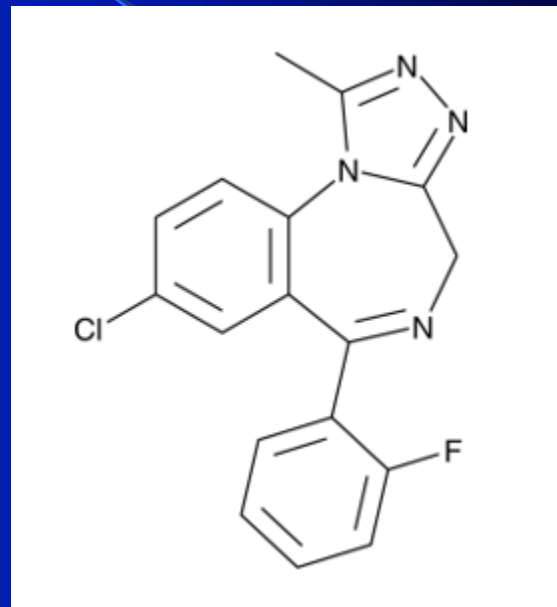
- Depressants
- Effects can include:
 - Sedative
 - Hypnotic (sleep inducing)
 - Anxiolytic (anti-anxiety)
 - Anticonvulsant
 - Muscle relaxant properties
- Many are listed as Schedule IV Depressants
- CAU has identified ~10 new benzos resulting in at least 33 cases since 6/2020 and becoming more frequent.

Benzodiazepine Analogues



Alprazolam

Schedule IV dangerous drug per
MCA 50-32-224(3)(a)



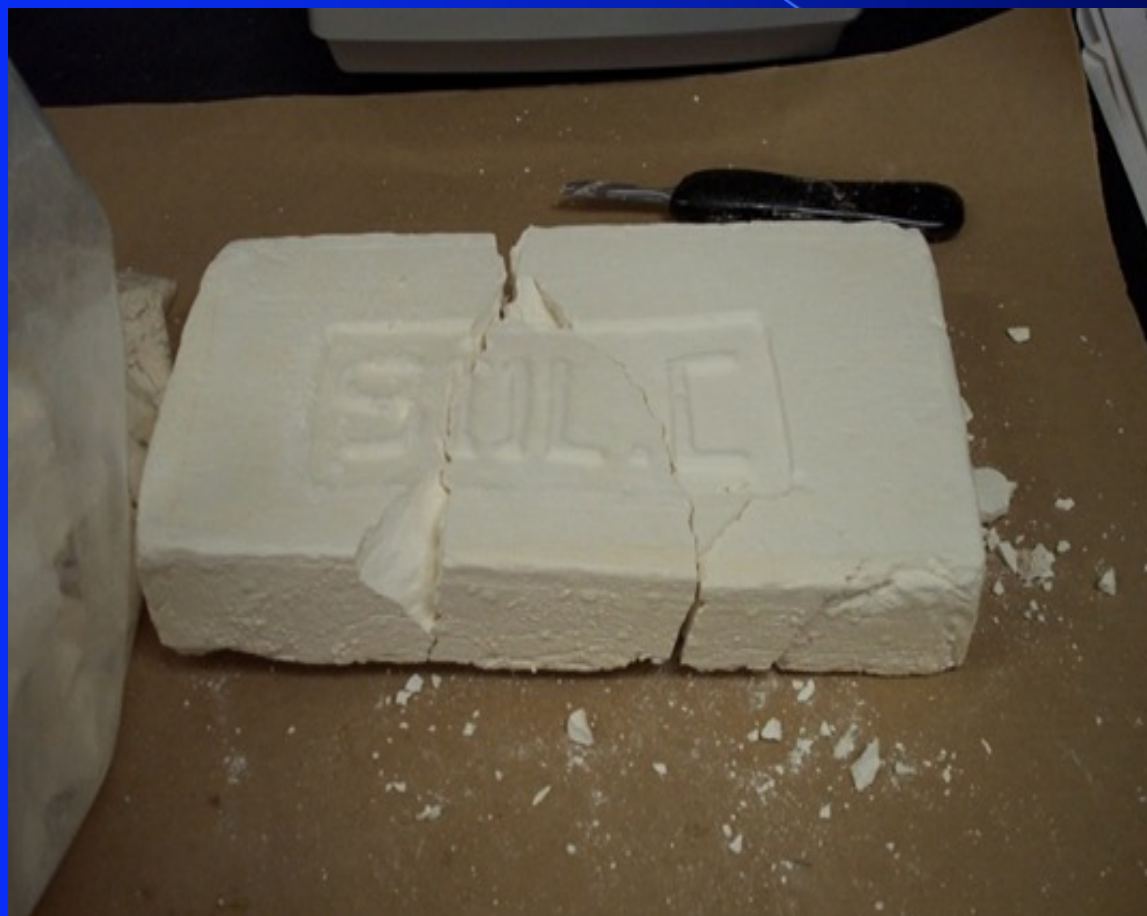
Flualprazolam

Schedule I dangerous drug
Analogue of Alprazolam per
MCA 50-32-222(10)

Psilocybin Mushrooms



Cocaine HCl



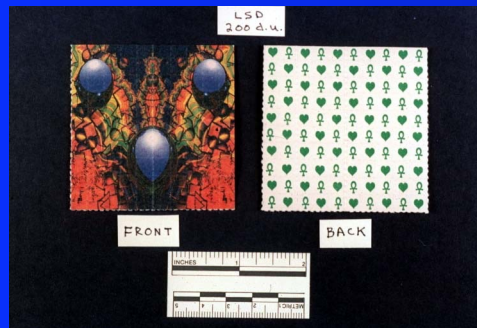
Cocaine Base or Crack



Pharmaceutical Tablets



LSD

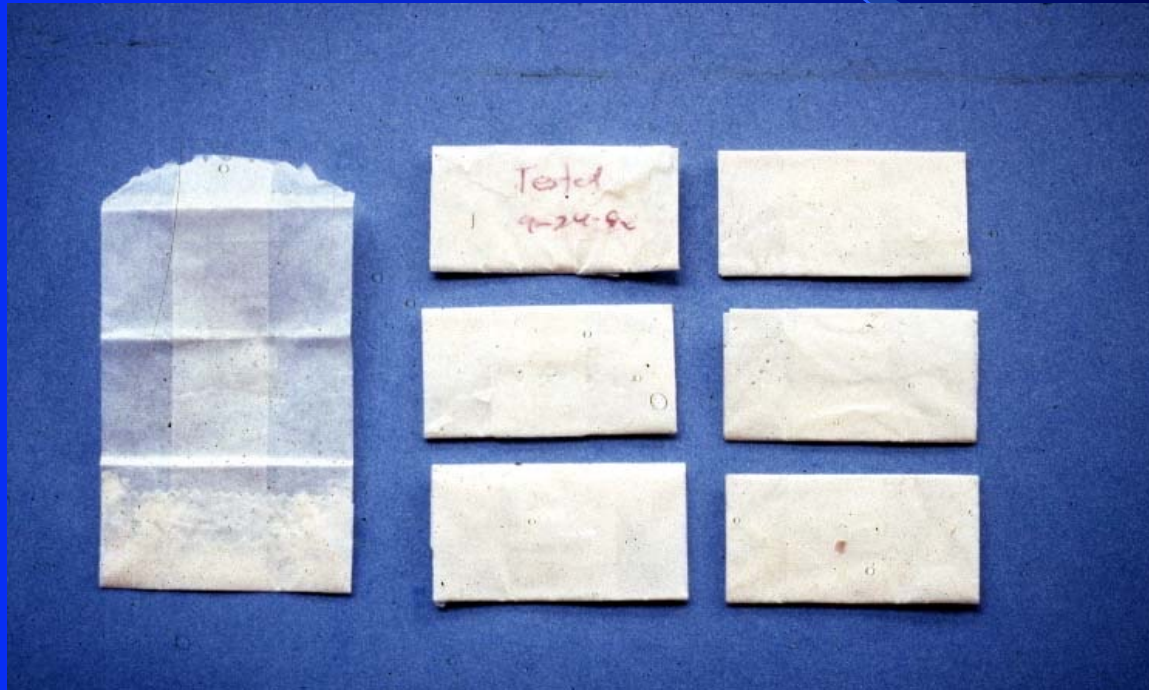


Black Tar Heroin

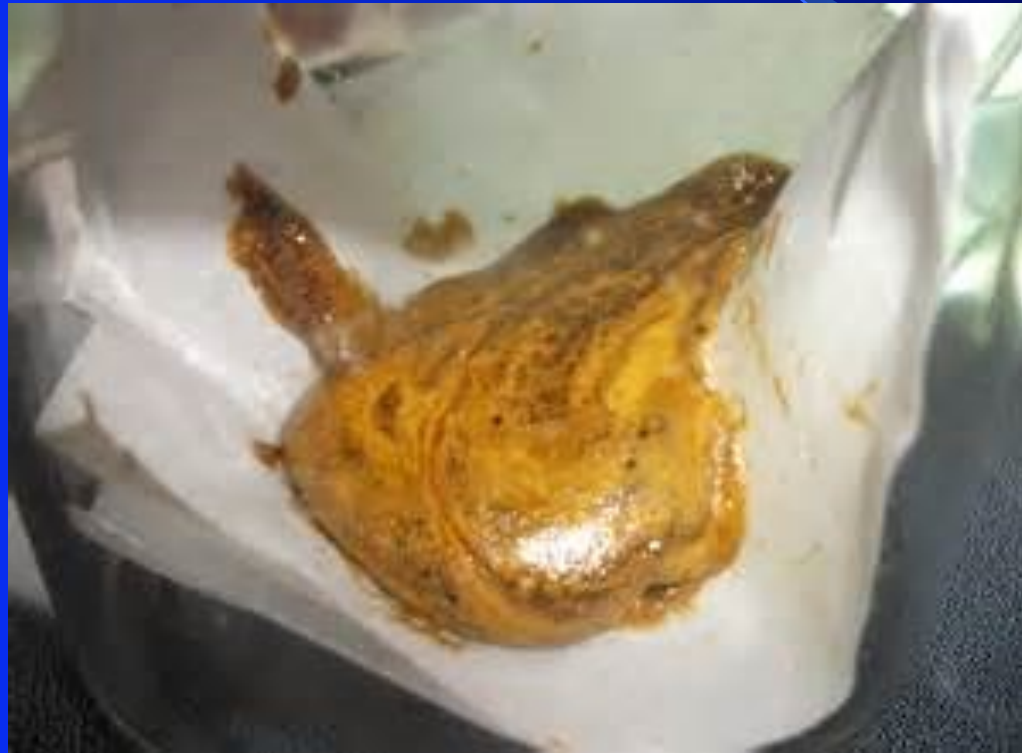


Heroin Tar
Photo by Boris73. © 2007 Erowid.org.

China White Heroin



Butane Honey Oil (Dab)



Hashish



Type of Analysis

- Qualitative Analysis: analysis in which substances are identified or classified on the basis of their chemical or physical properties.
- Quantitative Analysis: analysis in which the amount or concentration of an analyte may be determined and expressed as a numerical value.

Cannabis Marijuana or Hemp ???



Marijuana

Marijuana is defined in the MCA under 50-32-101 as:

all plant material from the genus *Cannabis* containing tetrahydrocannabinol (THC) or seeds of the genus capable of germination.

Marijuana vs Hemp

- Title 16 Marijuana regulation and Taxation
- under 16-12-102 Definitions states:
- (20) (a) "Marijuana" means all plant material from the genus Cannabis containing tetrahydrocannabinol (THC) or seeds of the genus capable of germination.
- (b) The term does not include hemp, including any part of that plant, including the seeds and all derivatives, extracts, cannabinoids, isomers, acids, salts, and salts of isomers, whether growing or not, with a delta-9 tetrahydrocannabinol concentration of not more than 0.3% on a dry weight basis, or commodities or products manufactured with hemp, or any other ingredient combined with marijuana to prepare topical or oral administrations, food, drink, or other products.

Hemp

Hemp is defined in the MCA under Title 80-Agriculture (80-9-101) as:

- all parts and varieties of the plant *Cannabis sativa* L. containing no greater than 0.3% tetrahydrocannabinol.

Hemp

2018 Farm Bill:

Legalizes Hemp production with serious restrictions

- Hemp cannot contain more than 0.3% THC
- Shared state-federal regulatory power over hemp cultivation and production.
- The law outlines actions that are considered violations and details possible punishments.
- Re-extends the protections for hemp research.

Hemp

- Allows cultivation, transfer of hemp-derived products with no restriction on sale, transport or possession as long as produced in a manner consistent with the law.
- Any plant containing more than 0.3 % THC would be considered Marijuana

Marijuana/Total Δ^9 THC

- Typically, Δ^9 THC and Δ^9 THCA are the most abundant cannabinoids
- Δ^9 THCA is converted to THC through decarboxylation when exposed to heat
- Δ^9 THC is greater than 0.3%

Hemp/Total CBD

- Contains other cannabinoids as the most abundant not Δ^9 THC
- We have seen cannabinalol, cannabidiol, cannabigerol, and corresponding acids
- Δ^9 THC must be below 0.3%

Challenges

- We do not perform quantitative analysis
- Another laboratory will have to analyze the plant material and determine amount of Δ^9 THC present
- Unable to distinguish Marijuana and Hemp based on the physical appearance of the plant material
- We do not homogenize the sample, only take a small portion to analyze
- If we analyze a sample and report Total Δ^9 THC, another lab may choose not to analyze it; therefore, no quant would be performed.

Recreational

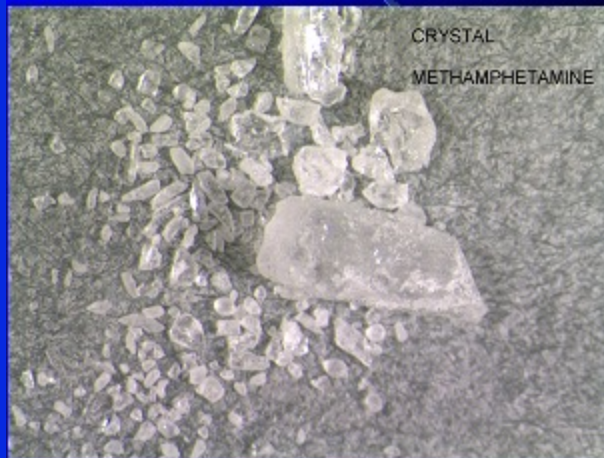
The following are the current felony threshold weights:

- If a person possesses more than 2 oz of marijuana, they may be charged with felony possession of dangerous drugs.
- If a person possesses more than 16 grams of marijuana concentrate, they may be charged with felony possession of dangerous drugs.
- If a person possesses more than 1 pound of marijuana, they may be charged with felony production or manufacture of dangerous drugs

Methamphetamine

- Methamphetamine is still the number one controlled substance identified in our samples.
- Most cases are in a crystalline form
- Approximately 2500 items analyzed in 2022 contained methamphetamine, that is roughly 60% of our cases

Methamphetamine



Other Emerging Substances - Xylazine

- A veterinary drug used to induce drowsiness and amnesia in animals.
- Reported to cause gruesome, painful wounds that have resulted in amputation in humans.
- It is being found in conjunction with fentanyl
- The crime lab has had 40 identifications of xylazine to date with fentanyl or related fentanyl analogues. It is not controlled in Montana or federally.

Other Emerging Substances – Tianeptine

- Also called “gas station heroin” because it is sold in convenience stores as well as online
- Sold as a dietary supplement but not FDA approved
- It is an antidepressant but affects opioid receptors in the brain. When misused, it functions similarly to opioids such as morphine, oxycodone, heroin.
- Currently legal in 43 out of 50 states, including Montana. We have not had a case yet.

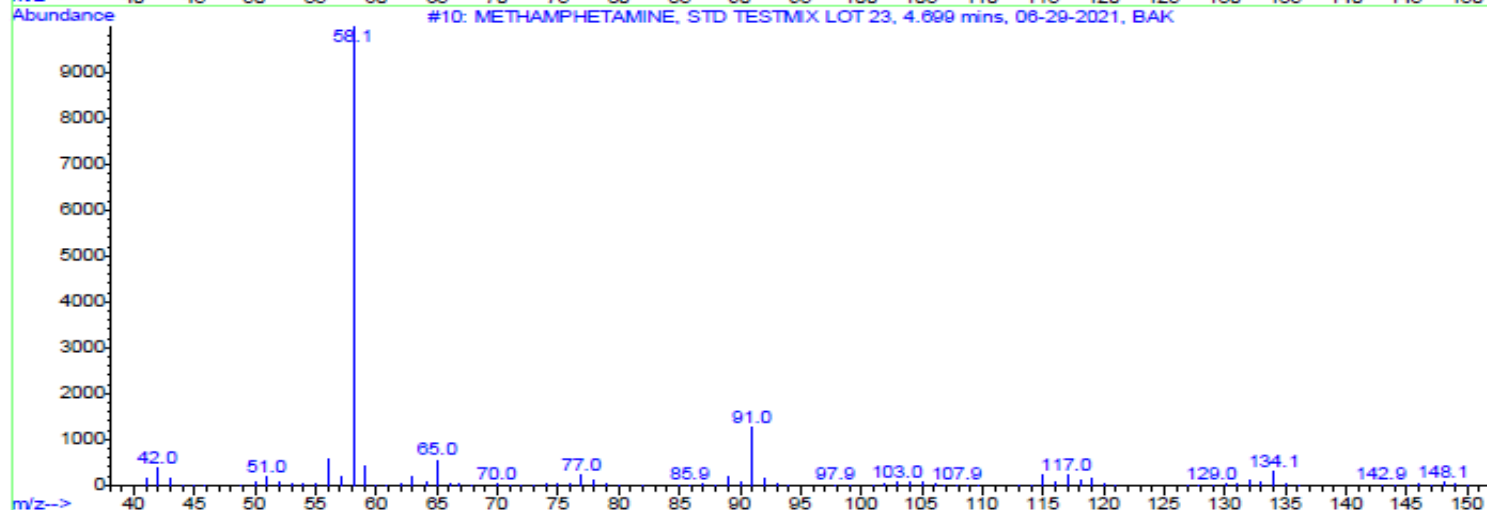
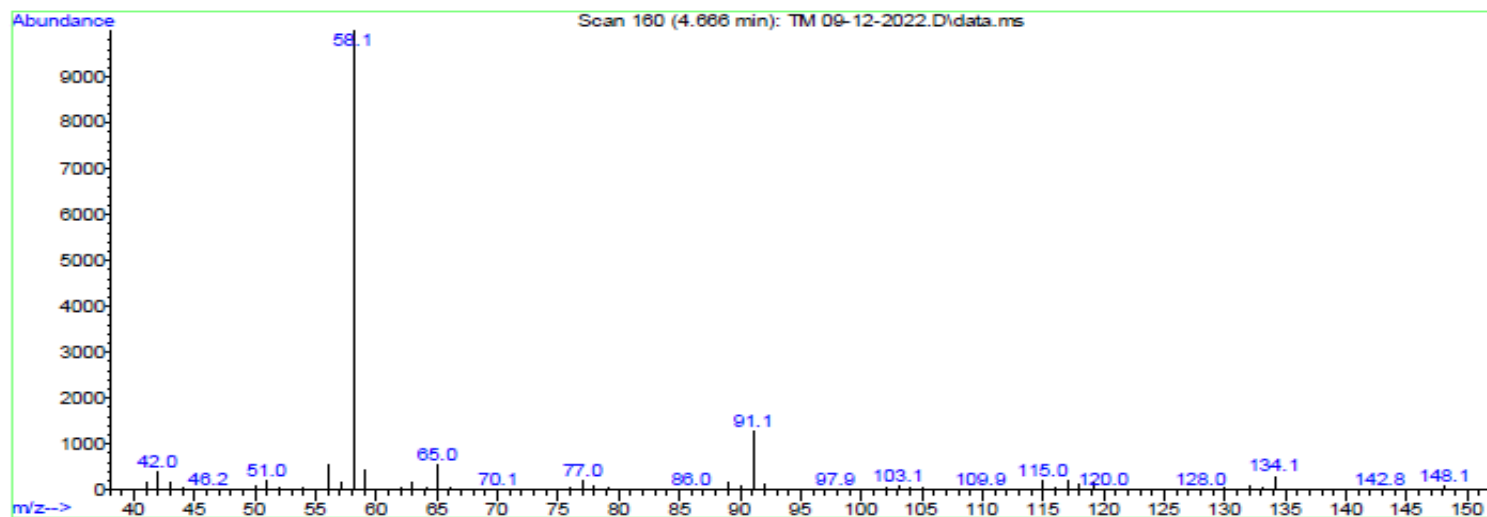


Gas Chromatograph - Mass Spectrometer (GCMS)



GCMS of Methamphetamine

Library Searched : D:\MassHunter\Library\DEXTER LIBRARY.L
Quality : 90
ID : METHAMPHETAMINE, STD TESTMIX LOT 23, 4.699 mins, 06-29-2021, BAK



Fourier Transform Infrared Spectrometer (FTIR)

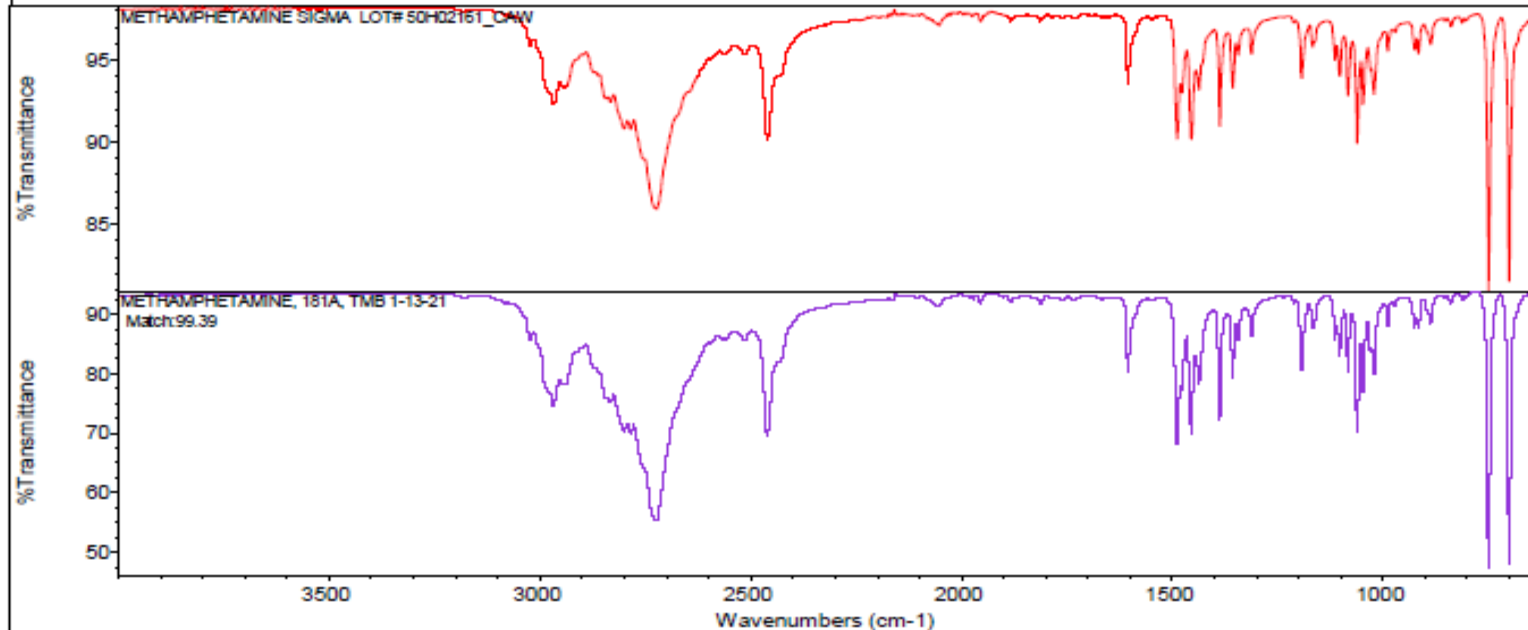


FTIR Data of Methamphetamine

MT FORENSIC SCIENCE DIVISION: Q-bert

ATR NICOLET iS10 S/N: AKX1502041

METHAMPHETAMINE SIGMA LOT# 50H02161_CAW



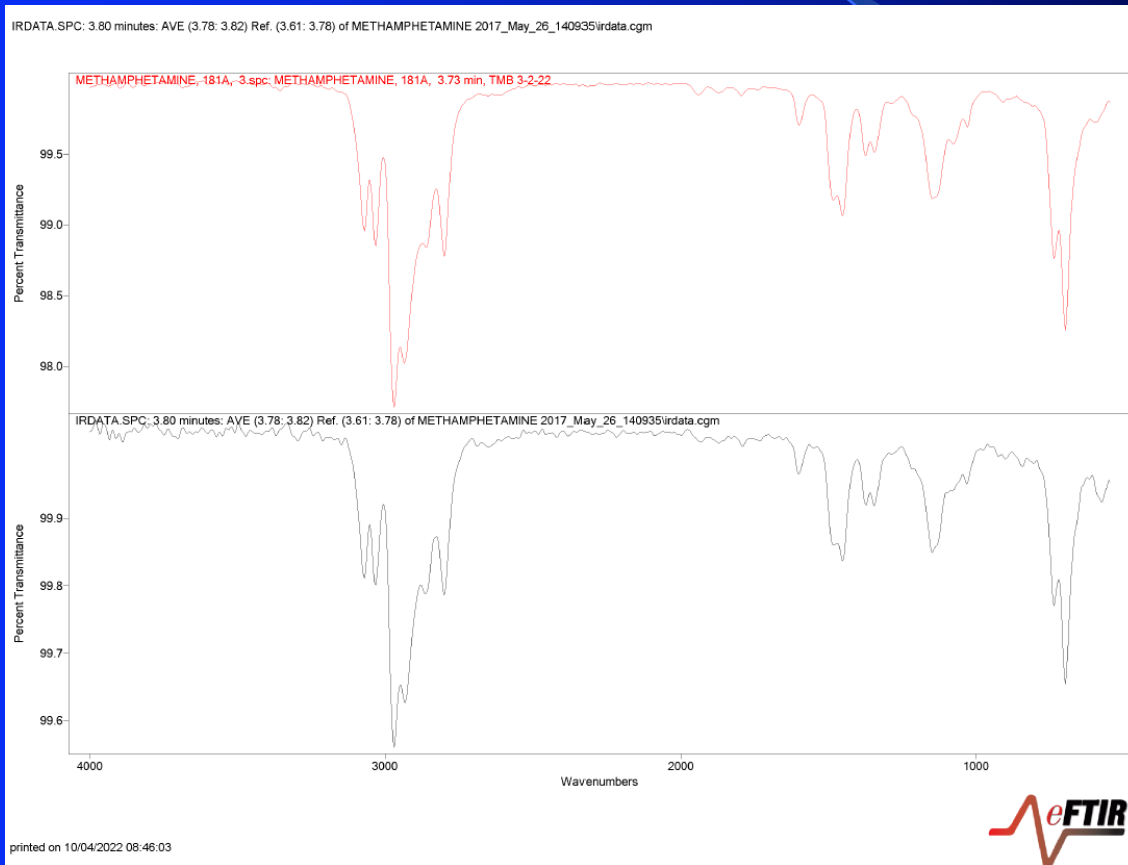
Collection time: Sun Nov 22 15:50:41 2015 (GMT-07:00)

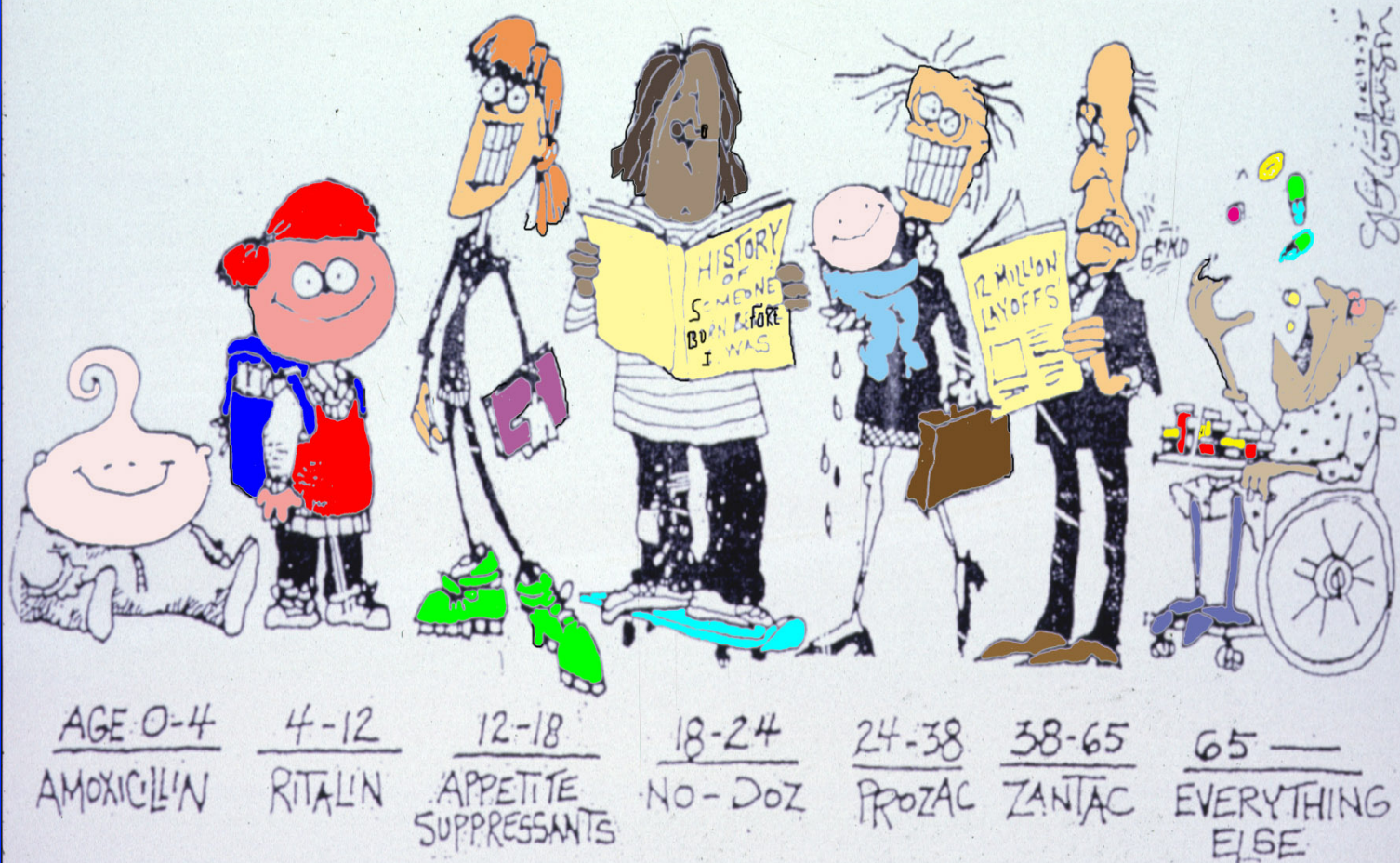
Number of sample scans: 16
Number of background scans: 16
Resolution: 4.000
Sample gain: 4.0
Optical velocity: 0.4747
Aperture: 80.00

Gas Chromatograph - Infrared Detector (GCIRD)



GCIR Data of Methamphetamine





SIGNE WILKINSON, Philadelphia Daily News

Thank you!